Vol. 11.] 1940. [No. 2.

# AGRICULTURAL JOURNAL

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CONTENTS.

VOLUME 11, NO. 2, JUNE, 1940.


MAP OF FIJI .. .. .. .. .. .. .. .. ..

EDITORIAL .. .. .. .. .. .. .. .. .. 31

A NOTE ON LAWAQA MARKET *by H. R. Surridge* .. .. .. .. 32

LOCAL FOOD PRODUCTION *by Dr. H. W. Jack* .. .. .. .. 33

BANANA DISEASE INVESTIGATION *by B. E. V. Parham* .. .. .. 36

EXTRACT—JEPSON'S BEETLE—JAMAICA .. .. .. .. .. 37

ENTOMOLOGICAL NOTES *by R. J. A. W. Lever*—

1. Wood-boring Beetles (Ambrosia and Pin-hole Borers) .. .. 38
2. The Maize Leaf-miner—with plate.. .. .. .. .. 39
3. The Green Vegetable Bug .. .. .. .. .. .. 40
4. Introduced and New Insects .. .. .. .. .. 41
5. Insect Pests of Dalo (*Colocasia*) .. .. .. .. .. 42

THE BANANA EXPORT TRADE *by A. B. Ackland* .. .. .. .. 43

THE PREPARATION AND COLLECTION OF GOAT SKIN FOR EXPORT *by C. R. Turbet* .. .. .. .. .. .. .. .. .. 44

ABSTRACT—THE FEEDING OF LIVESTOCK *by H. E. Woodman* .. .. 45

REVIEWS—

Fruit Flies in Malaya .. .. .. .. .. .. .. 48

Buildings and White Ants .. .. .. .. .. .. 48

Storage of Grain in relation to Insects .. .. .. .. 49

Copra Notes .. .. .. .. .. .. .. .. 50

Copra Grading .. .. .. .. .. .. .. .. 50

Coconut Charcoal .. .. .. .. .. .. .. .. 50

The Control of Weeds .. .. .. .. .. .. .. 51

Peanuts .. .. .. .. .. .. .. .. .. 52

EXTRACTS—

The Vegetable Oil Market .. .. .. .. .. .. 53

Protective Foods.. .. .. .. .. .. .. .. 54

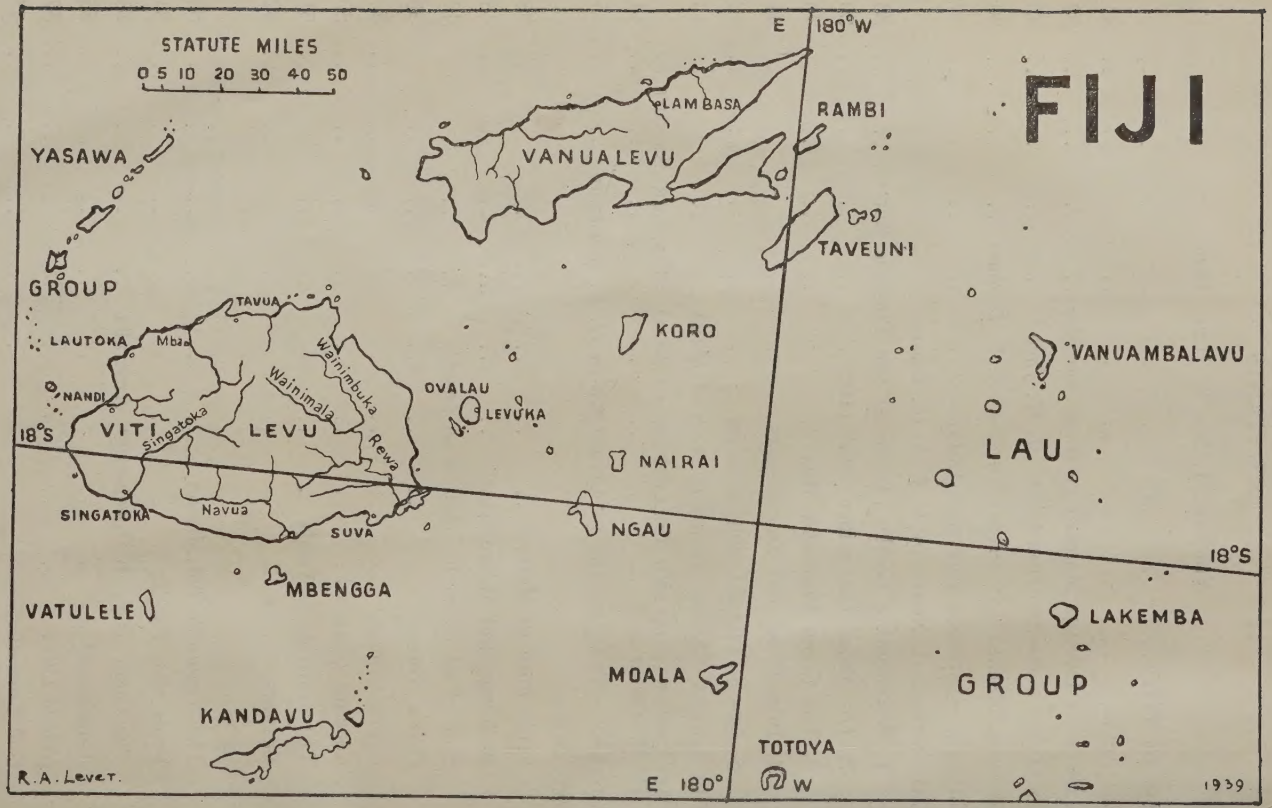
The Giant Toad in Queensland, Australia .. .. .. .. 55

Tangimauthia .. .. .. .. .. .. .. .. 56

Whale Oil .. .. .. .. .. .. .. .. .. 57

Soil Conservation .. .. .. .. .. .. .. .. 57

The R. H. Phillips' collection of Fijian Moths .. .. .. 58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# AGRICULTURAL JOURNAL

ISSUED BY THE

DEPARTMENT OF AGRICULTURE, FIJI.

VOL. 11.] JUNE, 1940. [No. 2.

## EDITORIAL.

IN this number of the Agricultural Journal, particular attention is directed to the importance of ensuring an adequate food supply for all classes of the community.

Despite the lavish provision of abundance of fertile soil a perusal of the local food supply situation shows that over £300,000—a considerable sum of money—is annually exported from the Colony to purchase foodstuffs and other commodities which might well be produced locally.

The most important commodities imported, instead of being locally produced are rice, "dhall," edible oils, biscuits, soap, tinned meat, tobacco and timber.

The Secretary of State for the Colonies has recently stated in the Bulletin of the Imperial Institute (Vol. 37, No. 1 1940) that "we are trustees for the well-being of the peoples of the Colonies" and that "the main purpose of our policy, even amongst the most backward races, is to have the colonial peoples to stand always a little more securely on their own feet, so that there is a steady development of freedom amongst all His Majesty's subjects in whatever part of the world they live."

Bearing this statement in mind, it behoves us to strive to be more self-reliant in the matter of the production of a reasonable proportion of our essential food requirements, the need for which is so well recognised at the present time.

Investigations on the control of banana diseases are briefly outlined in an extract which will be read with interest as evidence that progress is being made in this valuable work. It is shown that "leaf spot" disease can be readily controlled by periodic spraying with suitable fungicides. Scab moth "blemish" may be eliminated by use of locally produced "derris" powder which is little inferior to pyrethrum.

The selection of types of banana resistant to "bunchy top" virus and to other diseases has also made useful progress while thirty different local varieties and several introduced varieties are being studied for their commercial potentialities.

Banana rotation and cultural experiments are also being continued as important factors affecting economic returns, once control of diseases is effectively achieved.

Under entomological notes the occurrence of a green vegetable bug, *Nezara viridula*, is recorded and is of importance since it is known elsewhere as a pest of many locally grown crops of economic significance.

A note on wood-boring beetles indicates that many fruit trees are subject to attacks by several different species. Attacks can, however be successfully controlled by the routine treatment advised.

The damage caused to maize by a local leaf-miner is briefly described and it is shown that the pest is moderately well controlled by local parasites so that the pest has rarely assumed economic proportions.

A note adopted from a Jamaica publication emphasises the need for attention to the important matter of soil conservation and indicates a number of points worthy of adoption in local farming practice. Unless soil erosion is controlled, the continuity of production cannot be achieved and soil impoverishment is inevitable.

The potentialities of marketing goat skins are indicated in a note on the preparation and treatment. A market for these skins is worthy of trial when opportunity is available. Also, the value of the goat in the local meat supply is considerable and capable of further expansion.

Under reviews and extracts such practical subjects as the feeding of livestock, the control of weeds, copra notes and other matters are included in this issue and should prove of much interest.

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## A NOTE ON LAWAQA MARKET.

By
H. R. SURRIDGE, A.R.C.Sc. (I), B.Sc.

THE marketing of small quantities of Fijian and Indian produce in Sigatoka, in the past, was carried on each Saturday morning on the verandahs of sundry stores and on the beach at Vunasalu, a trading centre near the Sigatoka bridge.

The conditions of such marketing were unsatisfactory and after consideration by the District Officer and the Agricultural Officer the former allocated a small area of Government land at Lawaqa for the purpose of establishing a Saturday Market. This was carried into effect on October 28th, 1939, when the District Officer, assisted by the Agricultural Officer and other officers of this Department, opened the market for the sale of produce.

The opening day's attendance of sellers was encouraging, six Fijians and six Indians taking up their stands and readily disposing of their produce. The following week applications were received, from a Fijian and an Indian for permission to establish " Vale ni Kana " or refreshment booths. This was granted and during the next two months attendance of both sellers and buyers increased, together with the variety of produce offered, and by December 29th 40 Fijians and 20 Indians were attending regularly each Saturday, readily disposing of their fruit, vegetables, fish, poultry, and planting material.

It is estimated that some £20 worth of produce is sold each Saturday. The market has thus proved a boon to local residents who are assured of a regular supply of fresh produce at reasonable rates, and to both local and distant growers who appreciate the greatly improved facilities for the disposal of their surplus produce.

At present no charge is made for the use of the market. When it has become well established consideration will be given to the imposition of a small charge to provide for the proper care of the market area and, as funds permit, the erection of all-weather shelters. In the meantime temporary shelters have been erected by vendors themselves.

Unfortunately there is at present some concern that the market may have been killed by restrictions on the carriage of produce by local buses under the provisions of the new Traffic Ordinance. The small farmer depends on the bus service to take his goods to market, and although the Ordinance is concerned in this matter only to prevent overloading it has in fact discouraged bus drivers from accepting any produce at all.

## LOCAL FOOD PRODUCTION.

By
H. W. JACK, M.B.E., D.Sc., B.A.,
Director of Agriculture.

THE importance of ensuring an adequate food supply for the whole population and in particular for the poorer sections of the community, cannot be over estimated either in time of war or of peace and therefore a review of the food production position in Fiji may prove not only interesting but stimulating.

Nature has lavishly endowed this Colony with highly fertile soil and abundant humidity and there are few tropical food crops that cannot be grown at some season or in some climatic zone and yet, imported foodstuffs which could be grown locally are annually imported into the country to the value of some £210,000 (1939 figures). This is a substantial bill for such a small colony.

In addition to foodstuffs it may be mentioned that Fiji imports annually some £110,000 worth of products which could readily be produced locally and which thus represent an unnecessary drain of finance from the territory.

While the wet zones of the Colony may be more suited to the growing of staple crops such as coconuts, rice, sugar, bananas, " dalo," tapioca, sweet potatoes, cocoa, coffee, tea and similar high moisture demanding crops, the drier zones can produce rice (in season) maize, sugar, dhall and other pulses so that a very wide range of food crops may be cultivated satisfactorily. This is all the more reason why the imports of food materials for local consumption should be reduced.

Apart from the main cereal food crops, local production of food should include the growth of root crops, green vegetables, fruits, and, above all, animal products since these are of fundamental importance in the diet and are expensive to import.

In addition to the need to produce a reasonable proportion of his own food the peasant farmer requires to diversify his crops in rotations and to manure his land in order to maintain its fertility and towards this end, the keeping of stock is a highly important factor in the success of peasant farming.

While peasant farmers require to spend most of their time in working their mixed farms or in producing staple crops like sugar or coconuts they need encouragement in the production of a reasonable amount of foodstuffs to conserve their cash resources; in addition, such production has a stabilising effect in the promotion of contentment, which is a factor of vital importance in the development of the Colony.

The figures already quoted above indicate that approximately thirty shillings is annually sent abroad by every person in the Colony to purchase food or other materials which could readily be produced within the Country.

The chief foods imported include rice, tea, coffee, edible oils, canned meats, fresh mutton, potatoes, onions, preserved vegetables, bacon, ham, pork, cheese, sugar, honey, jams, jellies, pickles, spices, pulses, biscuits, tinned fish, salt and cocoa, while of other commodities tobacco, timber, soap, tallow and cordage form the main items.

Rice is the staple food of nearly half the total population of the Colony, and though the soil and climate are admirably suited to this crop and though local sale prices are high the annual import approximates 3,000 tons (2,883

tons in 1939) costing the country some £30,000 which is a substantial bill for a small agricultural colony to pay for one of its staple foods.

Efforts have been made to stimulate the production of local rice which is favoured by a tariff of £2 per ton compared with the imported product but with little apparent success, though it is admitted that more land is now planted with rice than in last season. Seed of high yielding strains has been distributed in a small way and land has been made available on favourable terms for growers of rice yet the response is, so far, inadequate to meet the normal local demand for rice, in fact it may be necessary to import more rice in 1940–41 than in 1939–40 owing to the adverse climatic conditions which have detrimentally affected the present crop.

It is estimated that some 17,000 acres have been planted with rice this season but this planted area must be increased by about a quarter, if sufficient rice is to be produced to eliminate the need for importing this product. It is important in these times that all imports should be reduced as much as possible in consonance with restricted shipping and high freight and other charges.

There are thousands of acres suitable for the cultivation of rice but in sugar areas the returns from rice, high though they are, do not attract growers and in copra producing areas, the opportunities for rice cultivation are restricted by other demands on labour. Irrigation would greatly extend the areas suitable to rice cultivation but, so far, the crop is entirely dependent on seasonal conditions which are highly variable and affect the crops accordingly. The Department of Agriculture is continuing its endeavours to interest Fijians in this crop but progress is extremely slow amongst a people who prefer root crops to rice as the mainstay of their diet and amongst whom there is little urge to plant rice as a cash crop.

Last year the Colony exported more than £28,000 in the purchase of 337,810 lb of tea, a large portion of which is labour tea such as could readily be produced by small holders or small planters with little capital and little machinery. This crop could be grown by small holders on contours, which are necessary in order to conserve soil on sloping lands or on practically any well drained soil in the wet zone of the Colony. A square chain or so would provide the small holder with sufficient made tea for his own family. It may be mentioned that Alpha Estate (Taveuni) once held a leading position in the tea world for the flavour of its leaf. Efforts are being made to multiply existing stocks of tea planting material with a view to stimulating interest in this valuable beverage amongst small holders as well as on estates.

In 1939 over £48,000 worth of tinned meat and tinned fish were imported into this Colony where fish should be readily available in abundance and where cattle, for the sub-tropics, excell. In addition, more than £6,700 was spent on imported bacon, ham, pork and mutton. Abundant good grazing lands can be found so that there is ample room for expansion of the beef and dairying industries, while pigs also thrive well under reasonable management and feeding. Normally the Colony now produces all its own requirements of butter and ghee but owing to adverse conditions in 1939 butter was imported to the value of £3,500 approximately.

Milk imports (tinned) are valued annually at about £7,500; this product is capable of being produced locally and as it is of such immense value in the diet of all races, it is hoped that existing conditions will stimulate the proportion of milk and milk products in conjunction with beef and goat meat. Raising goats for sale is at present reputed to be highly profitable.

Fresh and tinned vegetables to the value of £5,455 were imported last year whereas for most of the year quite a good range of vegetables can be grown locally and sold at quite reasonable prices.

The import of edible oils in 1939 cost the Colony over £11,700; yet its replacement by coconut oil locally prepared would not only be of material assistance to copra producers but would also insure a more wholesome product than much of the inferior mustard oil now imported. Alternatively, peanuts grow well in certain areas and produce excellent cooking oil.

Potatoes to the value of £12,487, also dhall and peas to the value of £15,645 were imported last year. Both these crops can be grown well in the dry zone, though storage of potatoes proves difficult and hence they can only be grown to supply the market over a three or four month season.

Considering that sugar is Fiji's main export it is curious to find that 578,517 lb of sugar valued at £4,053 were imported into the Colony last year while honey, golden syrup and cheese imports amounted to £385, £302 and £1,823 respectively.

Similarly spices, pickles, jams and jellies were imported in 1939 to the aggregate value of £9,155, though annual shows indicate that a wide range of such products can readily be produced locally.

Good coffee can also be grown in the Colony but the import last year amounted to over 45,000 lb worth £2,560. Other important imported foods include biscuits (£6,897), salt, (£2,648), cocoa and chocolate (£1,279).

In addition to food crops, imports of timber (£55,470), tobacco (£49,092), tallow (£3,206), soap (£6,997) and cordage (£11,769) are mentioned as the principal products that could be replaced by locally grown materials to the advantage of local primary producers and wage earners.

Sir John Orr, in *Nature* Vol. 145, No. 3674, 1940, in contending that 30 per cent. of the British population suffer in some degree from malnutrition owing to the high costs of protective foods, maintains that prices of essential foods should be stabilised so that they may become available to the poorest section of the people. He tentatively suggests the application of this principle to milk, potatoes, vegetables, oatmeal, bread, sugar and butter. This contention indicates that much attention is now being devoted to the problem of the provision of necessary protective foods to all classes of people, especially those foods which can be produced within the country and this trend is worthy of imitation in Fiji.

In the *Empire Producer* (No. 266, 1940), the speed and energy displayed by Italy in assisting Colonial development is eulogised, especially in the provision by the state of irrigation facilities for the production of essential foods. Such "deliberate planning" has achieved wonders of intensive development in Italy's African Colonies and shows that Italy "is prepared to experiment on a large scale and to back successful experiment with the necessary funds in a conscious national and united effort to build up a new civilization.

The obstacles to be overcome in Fiji and the disappointments experienced in endeavours to improve the lot of the people are many but in all such endeavours the adequate provision of necessary protective foods is surely of primary importance. Hence, it is hoped that these notes may draw attention to the needs for more consideration and more practical achievement in the matter of home production of essential foods, especially in these times as well as in peacetime.

## BANANA DISEASE INVESTIGATION.

By

B. E. V. PARHAM, M.A.,

Agricultural Officer (Plant Pathology).

(*Note.*—In view of general interest in the present position and future prospects of the banana industry the following extract from the Annual Report of the Department of Agriculture for 1939 is published. It gives a brief account of the work carried out at the Central Agricultural Station, Naduruloulou, on diseases of bananas, especially the leaf spot caused by the organism *Cercospora musæ* which is associated with the condition commonly known as Sigatoka disease.)

### BANANA DISEASES.

Routine experiments were continued in connection with the control of banana diseases, this work involving a great part of the programme at the Central Agricultural Station. These experiments were as follows:—

1. Spraying for direct control of leaf diseases.
2. Selection for resistance to bunchy-top virus.
3. Propagation of banana varieties with particular reference to disease resistant types.
4. Cultivation methods and yields of main commercial types.
5. Manurial trials.
6. Control of scab-moth blemish.
7. Rotation experiments.

*Spraying Trials.*—The direct control of banana leaf-spot disease (*Cercospora musæ* and associated leaf pathogens by means of spraying has proved entirely successful; the trials have been modified with a view to comparing the efficacy of the various available fungicides with special reference to costs and simplicity of application.

The fungicides used in 1939 were Bordeaux mixture 4–4–50, " Perenox " (cuprous oxide) and lime sulphur 1/50, and the value of the spreaders Agral III. and White Oil was investigated. The role of boron was also studied in the field.

While both Bordeaux mixture and " Perenox " gave complete control in the field, the results with lime sulphur were poor and some leaf-scorch was experienced. As a result of this work banana stools have now been in production at this station for upwards of four years and are still free from disease. Unfortunately the experimental programme was handicapped by the adverse effect of storms in February and again in December, which interfered with the records of yield of the various plots. By continuing the trials over an extended period it is hoped to minimise this loss.

The acquisition of an Arlington " Estate Model " portable power sprayer has facilitated the experimental work and reduced costs greatly; besides giving a much more uniform " coverage " than was attainable with hand sprayers.

The possibility of rehabilitating diseased stands of bananas by direct control of disease has been investigated with good results.

*Bunchy-Top Virus.*—Field work aiming at the selection of a Cavendish type banana resistant to bunchy-top virus was carried on and the selected clones propagated in progeny rows for observation.

*Variety Trials.*—The cultivation of the introduced varieties Lacatan, Congo, Giant Chinese, I.C.2., S 19, and Manila hemp (*Musa textilis*) was continued. Attention was given to the collection of local varieties of banana and plantain (" vudi ") varieties which now number thirty.

*General Cultivation.*—Cultivation methods, including spacing, pruning, cover cropping and composting received much attention. The importance of these factors becomes evident, once control of disease is effectively achieved, as increased yields are obviously necessary to offset the cost of spraying.

*Fertilizers.*—Manurial trials were strictly limited owing to the difficulty of adequate supervision—the sulphate of ammonia treatments were replicated in four plots with corresponding controls and the complete fertilizer was confined to one plot of 72 trees.

The beneficial effects of coral sand and regular green manuring and composting have been markedly demonstrated in the case of bananas.

*Banana Pests.*—The blemish of banana fruits caused by scab-moth (*Nacoleia octasema*) has always been most heavy in bananas grown on the lowland alluvial flats, and even in the best localities has called for regular use of a contact insecticide. The material in common use is pyrethrum powder which is dusted on the opening bunch after it has become infected and after some damage to undeveloped fruit has already occurred.

The study of the comparative toxicity of locally grown *Derris* dust and pyrethrum powder has been carried out over an extended period. The results indicate that the *Derris* powder is little inferior to the pyrethrum and improved methods of preparation may be expected to enhance its efficacy. The routine methods employed during the year have resulted in a very efficient control of this pest.

*Rotation Trials.*—The rotation plots have been well maintained, the crops being as follows:—

Plot I.—Maize Improved Yellow Dent, cowpea.
Plot II.—Kumalas, cowpea.
Plot III.—Sweet corn, Cavendish bananas, Soya bean and cowpea.
Plot IV.—Banana varieties, cowpea.
Plot V.—Veimama varieties (1935 stand.), cowpea.
Plot VI.—Tapioca.
Plot VII.—Rice, maize.

## EXTRACT.

### JEPSON'S BEETLE—JAMAICA.

*Plæsius javanus* Er.—On the 26th February, the second shipment of this predatory beetle was received from the Department of Agriculture, Fiji. Of this consignment, 192 beetles or 79 per cent. of those despatched from Fiji arrived alive. With a view to establishing a second centre of distribution to supply the western districts, one hundred of these insects were liberated in a heavily infested banana field in the parish of St. James. The other individuals were placed in a plot in St. Andrew where the 702 beetles from a previous shipment had been liberated. It is gratifying to note that eggs and larvæ of this predator were subsequently found in the field.

(From the Annual Report of Entomologist, Jamaica, for the year 1938.)

29 170



# ENTOMOLOGICAL NOTES.

By
R. J. A. W. Lever, B.Sc., D.I.C., A.I.C.T.A., F.L.S.

## 1. WOOD-BORING BEETLES (AMBROSIA AND PIN-HOLE BORERS).

In dealing with timber-borers in the *Agricultural Journal* for June 1938 (Vol. 9, No. 2), mention was made of a minute Scolytid taken by the conservator of Forests at Nadarivatu on *Endospermum* ("kauvula"). This ambrosia beetle has since been identified by the Imperial Institute of Entomology as *Xyleborus rameus* Schedl., not hitherto represented in the British Museum collections.

In addition to *X. perforatus* Woll. in coconut trunks and *X. morstatti* Hag. in avocado branches—mentioned in the article referred to above—six additional species of this genus have been taken locally and five of them identified in London. They are *X. testaceus* Walk. from twigs of *Hydnocarpus* sp. (which supplies chaulmoogra oil for leprosy) and citrus trunk; *X. mutilatus* Bldf. from avocado; *X. aplanatideclivis* Schedl. from *Inocarpus* ("ivi") nuts and avocado; *X. compactus* Erich from *Clidemia hirta* (Koster's Curse shoots); another species from a post of *Cassia nodiflora* on Vanua Levu and *Cryphalus jatropha* Samps. from stems of the ornamental *Acalypha wilkesiana* Mull–Arg.

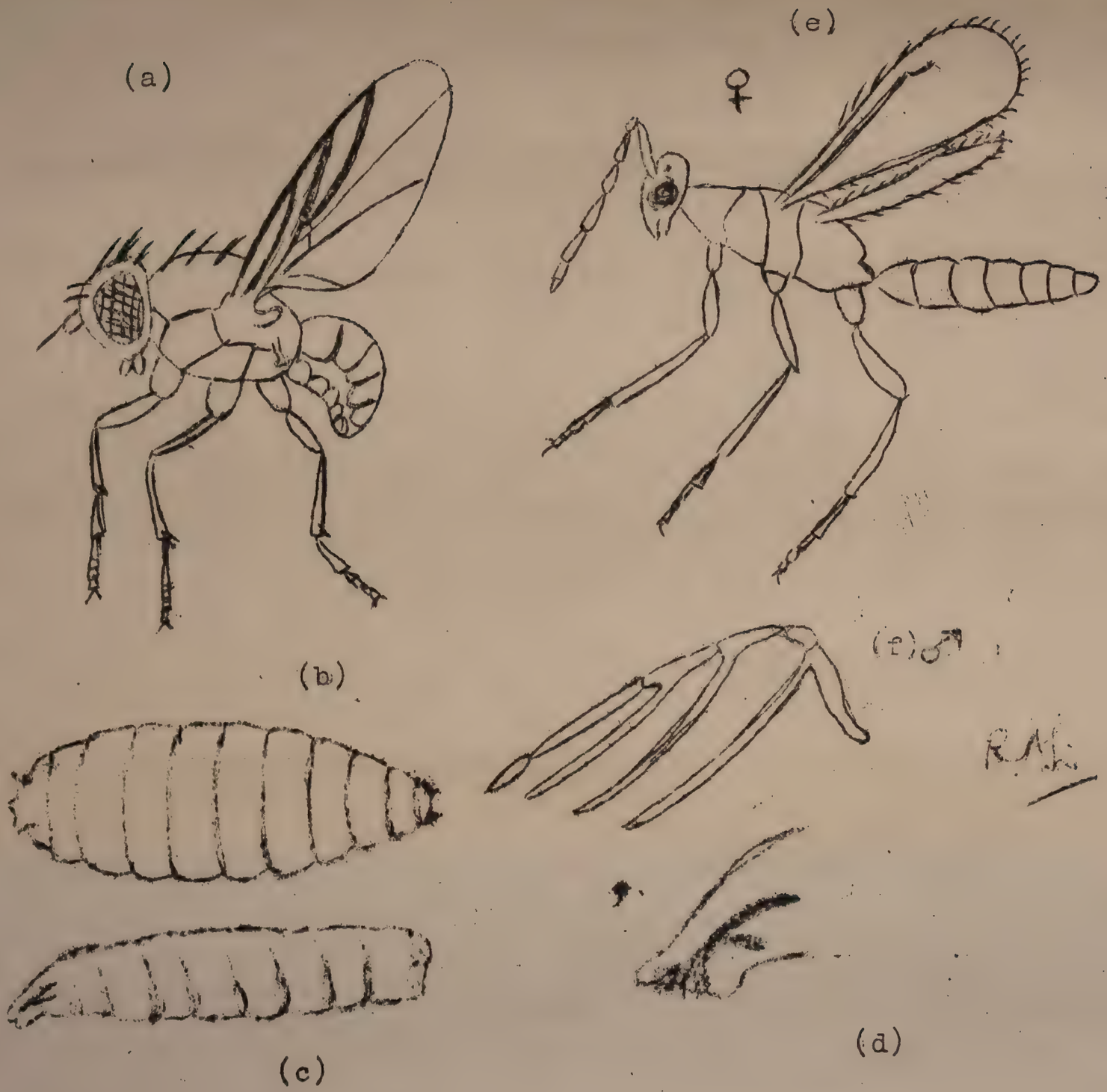
Severe pruning coupled with a paint consisting of ½ lb common soap boiled up in 1½ gallons of water to which 1 gill (or 5 fluid ounces) of crude carbolic acid has been applied to several avocado trees in Suva and given good results.

The closely related family of Platypodidæ are popularly known as shot- or pin-hole borers in allusion to their characteristic type of boring. They differ in one respect from the ambrosia beetles or Scolytidæ (Ipidæ) mentioned above in that they are chiefly attracted to trees already injured by fire, ring-barking, wounds or generally those in a sickly condition though they also frequent freshly-cut logs, planks or stacks of unseasoned timber, being attracted thereto by the sappy and moist green wood. An example of such a secondary pest is *Crossotarsus saunderei* Chap. from avocado branches and the trunk (at ground level) of a grapefruit tree growing under undrained conditions in very long grass. This is a shiny brown beetle measuring 4 mm. and like a miniature *Platypus gerstæckeri* Chap. mentioned in the article of June 1938.

It is of interest to note that this genus was coined in 1793 and given to these beetles in allusion to their flat legs (*Platypus* being derived from the Greek for flat foot) so that later when the duck-billed platypus of Australia was assigned this name it had to be discarded on grounds of preoccupation, this egg-laying mammal being then renamed *Ornithorhynchus*.

A true weevil which has been found to lay in logs into which its grubs bore is *Parendymia pilipes* Kirsch. which was found in February 1939 infesting stacked piles of "dogo" mangrove, *Bruguiera gymnorhiza* Lamk. It is assumed the weevil did not frequent the mangrove swamps but was attracted to the timber-yard which had stacks of dogo awaiting removal for firewood. This insect is blackish-brown, 6 to 10 mm. long with striate wing-covers.

The Bostrychidæ are the last borers to be dealt of which *Xylothrips religiosus* Boisd. was first taken in the South Seas in 1835 on the voyage of the French frigate *l'Astrolabe*. This is a beetle and not a thrips and it is recorded also from Samoa from the breadfruit tree and "vau" (*Hibiscus tiliaceus* L.). Its chief interest is a recent local record of its boring within the shoots of the large-leaved mahogany (*Swietenia macrophylla* King.) and also in avocado branches—a tree very prone to beetle attack. The writer was fortunate in




Maize Leaf-miner and its parasite.

(a) Adult Phytomyza spicata Mall. X 33.

(b) Ditto, pupa x 40. (c) Larva x 25. (d) Mouth-parts of larva.

(e) Hemiptarsenus parasite, female X 40.

(f) Ditto ,male antenna.

getting mahogany branches from the Waidina (sent by the then Agricultural Officer, South) which had up to eight beetles inside a cavity in one shoot. The adult insect is shining black with an abruptly truncated posterior and averages 7 mm. long. The flamboyante tree (*Delonix regia* Boj.) is attacked by *Xyloscopus castanoptera* Frm., but this is not serious.

Finally is the small *Dinoderus minutus* F., also a member of the family Bostrichidæ, which bores in the internodes of the bambo *Schizostachyum* sp. It is brown and measures only 3 mm.

The paint given above and judicious pruning are measures suitable for all these insects which flourish when the tree is unhealthy.

The reference to Paine's paper given in the Journal for March 1938 should be Vol. 7, No. 1, not No. 4.

It is regretted that the identification of the Vanua Levu ambrosia beetle cannot be obtained till after the war, if then, as the specimens were sent from London to a specialist in Germany at the end of August last and are in enemy territory still.

## 2. THE MAIZE LEAF-MINER.

In a pamphlet (1) published in 1917, details were given of a leaf-mining fly which occasionally did so much damage to maize as to prevent a crop being reaped though it normally merely checked the growth or caused a reduction in yield. The insect was described as an undetermined species of *Phytomyza* with two parasites, neither of which had been identified. It had not been a serious pest for many years before 1917 though it did some damage at Lautoka in 1909.

Last October maize leaves were found to be quite badly mined by the grubs or larvæ of this small black fly (Fig. *a*) which was identified as *Phytomyza spicata* Malloch known also from Samoa where it was taken in 1923 (2), the insect ranging as far north as Taiwan, formerly called Formosa. Greenwood (3) records *Pseudonapomyza atra* Meig. in Fiji as a pest of sugar, maize and *Sorghum halepense* Pers. (Johnston grass ?) but this is clearly due to following Bezzi (4) who, as shown by Malloch, had *Phytomyza* before him and not *Pseudonapomyza*.

The larva causes blister-like mines in the leaves running parallel to the veins or long axis and is capable of damaging them enough to check the plant's growth though no very severe injury was seen last year. The larvæ (Fig. *c*) which is ivory-coloured and 2·5 mm. long is fortunately heavily parasitised by a Eulophid wasp, *Hemiptarsenus*, which has branched antenae in the male (Fig. *f*) but simple ones in the female (Fig. *e*). It effected a parasitism of seventy-five per cent. in the Naduruloulou area and is the chief factor in controlling this pest whose sheltered site makes other than biological control measures difficult.

A pupal parasite, determined also by the Imperial Institute of Entomology as *Eucoila* sp., exercises such a small degree of control as to play a negligible role economically. The puparium of the fly is a typical brown, barrel-shaped structure (Fig. *b*) and pupation occurs in the mine or in the soil.

Artificial control of an insect whose whole development may be passed between surfaces of a leaf is extremely difficult owing to the absence of a vulnerable stage which can be reached by an insecticide. When the leaf-miner is abundant some factor has encouraged it at the expense of its parasite and Knowles (1) remarks prophetically that the fly could undoubtfully become a serious pest of maize if the ordinary relations between it and its parasite were permanently interfered with such as weather favouring the former more than the latter.

Cutting off the most severely injured leaf tips and placing them in fine wire gauge boxes in the field so that the minute parasites could escape but the larger fly would be retained is a measure that would be applicable for only small plantings of maize on a garden scale.

A solution of 1 part of nicotine sulphate in 500 parts of soapy water will kill not only the larvæ in their galleries but the young parasite developing within their bodies and this is clearly to be avoided when the parasite is abundant.

The best remedy is to chose a variety of maize which is found to suffer least damage from the leaf-miner, such as a tougher leaved variety and this is the only measure that can be recommended at the moment for a pest which until last year has given no trouble for a period of twenty-three years.

REFERENCES.

(1) Knowles, C. H.—1917. Department of Agriculture, Fiji, Pamphlet No. 27, December 28th.
(2) Malloch, J. R.—1935. "Insects of Samoa," Part VI, Fasc. 9. (British Museum).
(3) Greenwood, W.—1929. Proc. Linn. Soc. N.S.W., Vol. LIV, Part 4. October, 25th.
(4) Bezzi, M.—1928. "Diptera Brachycera and Athericera of the Fiji Islands". (London

### 3. THE GREEN VEGETABLE BUG, *Nezara viridula.*

A shield-bug *Nezara viridula* (L)., of almost tropicopolitan distribution has recently been recorded in Fiji. This insect rejoices in the name of the Southern green stink bug in parts of the United States but the shorter term green vegetable bug seems preferable for local use. It is over half-an-inch (15 mm.) in length by one-third (8 mm.) in width and is of a uniform green except for the membranous parts of the forewings which are transparent and the tips of the antennæ and eyes which are reddish-brown.

It might easily be mistaken for the indigenous shield-bug *Glaucias fijiensis* China but that insect has a distinct brown streak on the outer edge of the prorotum (the quadrangular plate in front of the triangular shield) and *Glaucias*, though about the same length as the *Nezara*, is slightly wider.

The importance of this pest is its wide range of host-plants including rice, cotton, maize, sugar, tobacco, cowpea, beans, pumpkins, tomato, sweet potato, citrus and cauliflower—an impressive list.

As stated above, this insect is almost tropicopolitan in distribution and it is surprising it has not been recorded from Fiji before. So wide is its range that it is now difficult to point out its original home, thus Myers (1) says it is indigenous to the West Indies (where it is a more serious pest of cotton than the stainers) while Drake (2) states it was "undoubtedly imported to the West Indies and North America many years ago."

The nearest places to Fiji where it is known to occur are Queensland and New South Wales to the west and Vavau, Tonga (3) to the east, in both of which countries it may also safely be regarded as an introduction.

The first specimens of this insect in Fiji were taken by the writer in the Rewa district on cowpea (*Vigna* sp.,) since then it has been recorded from Nadroga on cotton and in houses at light in Suva so it is evidently fairly well established on Viti Levu at least. Curiously enough, the specimen on cowpea was found only a day or so before a consignment of this insect arrived in December from Florida, parasitized by the Tachinid fly *Trichopoda pennipes* F. It was opened in Suva under strict quarantine and the bulk of the bugs forwarded by the same ship to Sydney, those that were retained in Fiji died very rapidly through having been twice put in coolers. None escaped but this transit shipment is mentioned though, as just stated, one bug was first seen in Fiji two days before the parasitized ones passed through Suva.

The eggs are laid in hexagonal clusters of 60 to 126 (2) on the lower surface of the leaf and their destruction by crushing is one method of control. As the pod-bearing *Crotalaria* is especially attractive this can be used as a trap crop which should only be attempted if regular supervised daily collection of the eggs, young nymphs and adults can be carried out. Any spray that kills this insect will also injure the plant so kerosene spraying of wild or non-useful plants can alone be employed. As the insect has only recently entered the Colony energetic hand-collecting should be of great use. So far as tomatoes are concerned, staking and pruning tend to check damage and any cover crops should be cut down and ploughed in as the bug delights in their shade. An egg parasite, *Microphanurus basalis* gives some control in New South Wales and might be introduced later.

This article is to be regarded more as a warning than anything else as it is not known how thorough is the distribution of this plant or what are its capacities and host-plant preferences. The writer will be pleased to receive correspondence from anyone finding this insect which should not be confused with *Glaucias* if the points mentioned above are followed.

(1) Myers, J. G.—1931. *Empire Marketing Board Publication* No. 42. July.
(2) Drake, C.—1920. *Quarterly Bulletin, State Plant Board of Florida*, Vol. IV, No. 3, April.
(3) Cottrell-Dormer, W.—1940. Official letter. April 29th.

## 4. INTRODUCED AND NEW INSECTS.

In March, 1938 (1), a small Indian parasite *Syntomosphyrum indicum* Silv.—was liberated to control the fruit-fly *Strumeta passiflorae* (Frogg.).

About 8,000 were bred up and released and last March some fruit-fly pupæ collected in the field at Nasinu were found to be parasitised by this tiny wasp which therefore appears to be established in two years.

The Histerid beetle—*Platylister chinensis* Guen.—liberated in November, 1938 (2), was found by the collector of this insect in Java—Mr. H. W. Simmonds, O.B.E.—to have established itself in cow droppings in the Suva area and to be fairly abundant in February. Colonies of this beetle have been sent to Samoa and the British Solomon Islands and can be expected to survive in those islands.

Besides the green bug, *Nezara viridula* (L.), which is dealt with in detail in a separate note, a large black and yellow Sphegid has recently been taken in Suva. This spider-hunting wasp is *Sceliphron cæmentarius* Drury and is a mud-dauber known on the eastern American seaboard. The first specimen in Fiji was taken by the author on Christmas Day last year and it can be presumed that this insect arrived from Hawaii—which it had reached prior to 1899 (3)—in its pupal earthern cells inside merchantise.

Lastly the small red-brown weevil *Proecës præustus* Mshll., previously recorded only from Samoa (4), was taken at light in Suva in November, 1939. As it was first found in the rain-forests of mountainous Savaii it may be regarded as an indigenous insect not recorded before.

The writer is indebted to the Director of the Imperial Institute of Entomology for these identifications.

(1) *Fiji Agric. Jour.* 1938, Vol. 9, No. 2, June.
(2) *Fiji Agric. Jour.* 1938, Vol. 9, No. 4, December.
(3) Perkins, R.C.L. and Forel, A. 1899. "Fauna Hawaiiensis," Vol. I, Pt. 1. Cambridge.
(4) Marshall, Sir Guy, 1931. "Insects of Samoa," Part IV, Fasc. 5. London.

## 5. INSECT PESTS OF DALO (*Colocasia*).

THE dalo of the Fijians is identical with the taro *Colocasia esculenta* Schott. of other islands of the Pacific and forms the staple root crop, besides a spinach, of the natives and it is also eaten to a lesser extent by all other races in the Colony. Increased cultivation of this plant has followed the outbreak of war and information on its insect pests is therefore of value.

The most serious damage is done by the hawkmoth, *Hippotion celerio* L., whose large green caterpillars with a terminal spine may defoliate the plants leaving only the stalks and midribs. Such an outbreak occurred at Ono-i-ra, Kadavu, in September, 1939, and was controlled by calcium arsenate and bran baits and a spray of arsenious oxide—sweet potatoes were also attacked. The moth itself is brown with white streaks on the forewings, while the hind wing has black markings and, usually, crimson blotches—the wing span is 6 to 7 cm., just under three inches.

The cutworm, *Prodenia litura* L., has also been recorded as a pest and can be controlled by the same poison bran bait as given in the *Agricultural Journal* for October (1).

The cotton aphid, *Aphis gossypii* Glover, is occasionally a pest of the leaves but is easily controlled with a kerosene-soap emulsion spray if a Syrphid fly and ladybird cannot keep it under, these being its natural enemies.

A brownish-black plant-bug, *Brachylybas ventricosus* Le Guill, also feeds on the sap and can be controlled in the same manner as the aphid. It is about one-third of an inch in length.

Of more immediate interest is a small leaf-hopper *Megamelus proserpina* Kirk., which is reported (June) doing considerable damage to taro in Ono-i-ra. It is an active leaf-hopper 4 mm. long, black in colour with a median yellowish-white streak. Its distribution is from the East Indies to Samoa and Niue (Savage Island) and northwards to the Philippines where it is controlled by two egg-parasites (2). A small predacious Capsid bug, *Cytorhinus fulvus* Knight, with black head, thorax and wing tips and orange-red wings and legs is usually associated with the hopper but does not seem to exercise much control in Fiji though introduced into Hawaii (3) with the egg-parasites *Paranagrus* and *Ooetetrastichus*.

This note is to be regarded as an interim one as work on *Megamelus* is in progress at the moment.

A potential enemy which must be kept out of the Colony is the black Dynastid beetle *Papuana* spp. which occurs in the Gilbert and Ellice Islands to the north-west. They are very destructive to the underground portions of the plant and cause much loss in both the Gilberts and Solomon Islands.

(1) *Fiji Agricultural Journal* 1939.—Vol. 10, No. 3, October.
(2) Fullaway, D. T., 1937.—Proc. Hawaii Ent. Soc. Vol. IX, No. 3, Sept.
(3) Proc. Hawaii Ent. Soc. 1939, Vol. X, No. 2, December.

## THE BANANA EXPORT TRADE.

By
A. B. ACKLAND, E.D.,
Produce Inspector.

EXPORTS of bananas for 1939 show a decided reduction on the quantity for the year 1938. Exports for the years concerned have been as follows:—

| | 1938. | 1939 |
|---|---|---|
| New Zealand .. .. .. | 149,365 cases<br>4 bunches | 55,865 cases<br>19 bunches |
| Canada .. .. .. .. | 20 cases<br>17,656 bunches | .....<br>1,242 bunches. |

The fall in exports is of course due to the gales and floods of the early part of the year which caused serious damage to plantations.

It became necessary to cease shipping to Canada in February owing to a shortage of suitable bunches.

The prices paid to growers at packing stations remained at 4s. 6d. per case for Viti Levu, Beqa, Ovalau and Moturiki and 3s. 6d. per case for the island areas until the early part of March when the excess profits earned by shippers during the year 1937 had been refunded to producers and prices were reduced to 4s. and 3s. per case for the respective areas.

The Colonial Secretary and the Produce Inspector visited Wellington in February, at the invitation of the New Zealand Government, to discuss a new agreement for the sale of Fiji bananas on a free on board Suva, basis. Under the old agreement the New Zealand Government purchased the fruit at a price of 10s. 3d. per case New Zealand currency f.o.b. Suva (Fiji equivalent approximately 9s. 1d. per case). The new agreement arrived at in Wellington and confirmed by both Governments favoured the grading of the fruit into two qualities and the payment therefor at prices of F9s. 4½d. for first and F8s. 8½d. per case for second grade f.o.b. Suva. The new agreement came into effect for the shipment per m.v. "Matua" on the 16th March. Exports since the introduction of the new agreement have been graded as:—

| | |
|---|---|
| A grade .. .. .. .. .. .. | 82·3 per cent. |
| B grade .. .. .. .. .. .. | 17·7 ,, |

The average return per case f.o.b. Suva was F9s. 3·1d.

The Banana Committee which reported to Government on the 5th May, 1938 (Council Paper No. 40) recommended the formation of a co-operative company of exporters which would ship the whole of the exports of Native produced fruit. For various reasons and with the approval of Government the formation of the proposed Company was deferred; an export pool was however, formed and commenced operations with the shipment on the 28th September and so far is working satisfactorily

A feature of the export pool is that a Fijian Company (Fijian Producers Association) shares in the pool with European buyers. The Fijian Producers Association has carried on its business fairly well considering the unusual difficulties which were experienced during the past year.

The ready co-operation of the shippers was of much assistance as usual.

## THE PREPARATION AND COLLECTION OF GOATSKIN FOR EXPORT.

C. R. TURBET, M.R.C.V.S., B.V.Sc.

The goat population in Fiji is large and it is likely therefore that a considerable number of these animals are killed annually for food. Properly prepared goat skin has a very definite value in the World's market, and if the flaying, drying, and collection of these skins can be done in a skilful and economical manner it is possible that some trade may be developed in this commodity to the advantage of the producers.

In flaying, it is best to use the knife as little as possible. The skin is preferably removed by making primary incisions and punching the skin away from the carcase. No knife cuts are left on the skin using this method.

There are various methods of curing skins for export. One method is to stretch the skin, without using too great a tension by lacing the sides to a wooden frame. The skins are allowed to dry in the shade where there is a good drying breeze.

Another method is to lay the skin hair downward on a cement or wooden floor and to rub salt into the raw surface. The salt is left on the skin. The next skin to be treated is then placed hair downward on the first and the process repeated. In this manner a stack of skins is built up.

A dip for skins in the following arsenical solution is approved by Karakil skin dealers in London:—

| | | |
|---|---|---|
| Arsenic | .. .. | 2·7 oz. |
| Washing soda | .. | 3·3 oz. |
| Water | .. .. | 1/3 gall. |

Place in a pot and boil, stirring constantly. Remove from the fire and add 2/3 gallon of water stirring it in to the more concentrated mixture. One gallon of this mixture is suitable for 30 skins. After treating spread the skins on a clean floor, fur side down. Spread all parts of the skin evenly and sprinkle a coating of bran over the skins. The bran, however, should be carefully brushed off before packing for shipment.

In packing skins they should not be doubled up but packed flat one against the other, skin sides together, and in this manner tied up in flat bales.

Before packing, all skins should be inspected for signs of putrefaction, and if any, should be discarded for export purposes. If in good condition they should be packed as tightly as possible in bales and forwarded to Suva for export through one of the local Agents.

In country centres it will be necessary to secure the services of a local agent to attend to the collection and baling of the skins. At this time full use should be made of all possible exportable products. In the past it appears that the whole of our local goatskins have been wasted.

# ABSTRACT.

## THE FEEDING OF LIVE STOCK BY H.E. WOODMAN.

(Journal Royal Agricultural Society of England Volume 100, Part 1, 1939.)

### NUTRITION OF THE PIG.

*Vitamins—Vitamin A.*—1. It has been found that cod liver oil and carotene are equally efficaceous as sources of Vitamin A for pigs, carotene is the yellow plant pigment found in carrots, grass and many other plants.

2. A deficiency of Vitamin A in the diet of pigs causes in the long-run, grave injury to the central nervous system leading to partial or total paralysis. The usual results of Vitamin A deficiency as seen in the rat-retarded growth and eye disease—were not seen in the pig.

3. The quantity of Vitamin A required daily to be consumed by a pig to protect against disorders of the nervous system is 2500 international units. This amount of Vitamin A is contained in about $\frac{3}{4}$ ounce of young fresh grass. It is small wonder, then, that paralysis associated with Vitamin A deficiency is seldom noted in pig-breeding practice.

4. Four factors are held mainly responsible for this satisfactory state of affairs: (1) It is common practice for young pigs either whilst on the sow or as weaners, to be allowed out to pasture. In this way reserves of Vitamin A and or carotene are stored up in the body of the animals, chiefly in the liver. (2) In many piggeries (as in Fiji) green food is fed to the pigs or alternatively the ration contains a small percentage of dried grass meal or lucerne meal. (3) Many farmers include cod liver oil in the ration of their pigs. (4) Pig dietaries frequently contain up to 30 per cent. of yellow maize, a food that supplied a second Vitamin A precursor known as cryptoxanthine.

5. The young pig is able to store large quantities of Vitamin A: enough for its life—weighing up to 200 lb—in the liver. It has been suggested that the Vitamin A requirement of a pig could be provided for life by administering a single massive dose of Vitamin, that is, in a gelatin capsule containing 2·7 grams of potent Vitamin A concentrate. In the same manner a diet of $\frac{1}{2}$ per cent. cod liver oil throughout the life of the pig is sufficient to guard against the disorders of Vitamin A deficiency, but it is suggested by the authors that a more practical method might be to feed 1 per cent. cod liver oil up to 3 months of age and none thereafter.

6. (Under the system of pig raising practiced in Fiji, that is, raising pigs confined on concrete, the addition of a supply of fresh green grass to the daily ration is the most economical method of protecting the pigs against Vitamin A deficiency.)

*Vitamin B.*—Although it has been established by experiment that the pig is extremely susceptible to dietary deficiency of the B complex and its component factors, such deficiencies are not to be feared in the slightest degree under normal conditions of feeding.

*Vitamin C.*—It would appear from the results of experimental work that the pig is not susceptible to a dietary deficiency of Vitamin C, the anti-scorbutic factor.

*Vitamin D.*—It is now generally accepted that if the pig's ration supplies adequate amounts of calcium and phosphorus in suitable ratio the Vitamin D requirements of the pig are small. The action of sunlight on the skin of the animal will produce sufficient Vitamin D to ensure satisfactory assimilation and utilization of the lime and phosphate. When, however, the dietary calcium or phosphorus or both are allowed to fall to a dangerously low level

the administration of cod liver oil (containing Vitamin D) will enable the pig to make much better use of these minerals than would otherwise be possible and so safeguard the animal against rickets.

MINERAL SUPPLY.

*The effects of Phosphorus Deficiency.*—Phosphorus deficiency in the diet of young animals invariably causes rickets or osteomalacia. The effect of phosphorus deficiency is aggravated by a relatively high calcium (lime) content in the diet. The best growth is obtained when the ratio of calcium to phosphorus lies between 1 : 1 and 2 : 1.

*Anaemia of Young Pigs.*—This disease which is due to a deficiency of iron in the diet does not respond readily to treatment with iron salts after the disease is well established. Where the disease is likely to occur however preventive treatment by the administration of iron salts from 2 weeks of age onwards gives good results. Iron pyrophosphate is the best iron preparation for the prevention of the disease.

Anaemia in young pigs is most likely to occur when confined in a sty and when subsisting solely on mother's milk. This is due to the inability of the sow to pass on her dietary iron to her piglets through the milk. (Under the system extant in Fiji of rearing pigs wholly confined to sties, it is necessary therefore to make iron available to the young pigs as a supplementary ration.) Iron pyrophosphate, which is not astringent or distasteful, is the best iron preparation for the prevention of the disease (Sulphate of iron is the preparation which has until now been recommended for the incorporation in mineral licks by the Department of Agriculture in Fiji).

*Protein supply for Pigs.*—It has come to be generally accepted that in feeding weaner pigs, food rich in protein 10-12 per cent., such as fish or meat meal is required along with other foods. At 90 lb weight, 10 per cent. meat meal is sufficient and beyond 150 lb it may be eliminated altogether. Experiments at Cambridge now indicate that equal growth rate can be obtained with a lower protein intake particularly for the bacon pig. The low limit of protein supply consistent with rapid growth and satisfactory carcase is yet to be determined.

In the Lihmann system of pig feeding practised in Germany, pigs are fed according to usual standards until about 50 lb in weight. They are then gradually put onto a basal ration of 2½ lb of protein rich concentrate. This amount does not vary. In addition the pig is allowed to consume as much as it can of farm produced products such as root crops and green fodder.

NUTRITION OF POULTRY.

*Vitamin Supply.*—Stress is laid on the complex nature of Vitamin B. Birds are extremely susceptible to a deficiency of this factor in the dietary.

*Vitamin B*1, is protective against and curative of polyneuritis (a form of paralysis) in fowls.

*Vitamin B*2 contains several factors, two of which are important in chicken feeding, (*a*) riboflavin, a factor essential to growth and possessing other functions, (*b*) the chick dermatitis preventive factor. Vitamin B is obtained in nature largely from the germ of cereals such as wheat and maize. It can, however, be now made synthetically and be supplied and fed in known quantity.

The riboflavin content of the laying hen's ration is important in determining the number of eggs laid and the ability of the eggs to hatch into vigorous chicks. In the absence of a sufficient quantity of riboflavin, in

the diet of laying hens, eggs dificient in this factor will be laid. The egg white of such an egg will be almost colourless, whereas in an egg from a hen receiving adequate Vitamin B the egg white has a greenish-yellow tinge.

Chicks on a diet deficient in riboflavin may be affected with an acute paralysis or a more chronic type known as "curled toe" paralysis.

*Vitamin A* is contained in grass, yellow maize, and cod liver oil. Its presence in the diet of chickens is necessary to promote growth and resistance to disease. In the adult hen it promotes normal egg production. Strangely enough there is evidence to show that when cod liver oil is given as the main source of Vitamin A in the ration of cockerels, semen production is depressed.

Resistance to such infections as coccidiosis is to some extent proportional to the concentration of Vitamin A (cod liver oil) in the ration.

*Mineral Supply.*—The skeletal tissues of the fowl can supply calcium for egg shell formation when the available calcium in the food is insufficient for the purpose. Nevertheless in fowls on a low calcium the normal egg-laying cycle is markedly affected.

The authors conclude that two entirely different types of birds may be produced in a flock fed on a mineral-deficient diet: (1) a small bird that has utilized the available mineral to build up a comparatively normal skeleton, the latter, however, being comparable in development only to that of a bird of the same weight, but very much younger age, fed on a normal ration, (2) a moderately large bird that has grown at the expense of its skeletel structure, which shows, as a consequence typical rachitic lesions (ricketts).

It may come as a shock to learn that excess of calcium in the diet may have undesirable effects. An unduly large percentage of limestone or oyster shell grit in the diet decreases vitality and increases the susceptibility of chickens to coccidiosis.

An absolute manganese deficiency is responsible for the condition in chicks known as perosis, or slipped tendons. A trace of manganese is sufficient to prevent and cure this condition. A very high calciumphosphorus concentration in the diet reduces or prevents the absorbtion of Manganese from the intestinal tract.

Deficiency in this element may also lead to retarded growth and to decreased egg production with low hatchability.

*Protein Supply.*—Experiments conducted at the National Institute of Poultry Husbandry reveal that the protein requirement for laying hens is appreciably lower than those advocated in current feeding standards. Hens on a diet containing 12·5 per cent of protein gave as good egg production, egg weight, health and body condition as those on a diet containing 15·4 per cent. of protein.

## GRASS DRYING.

Much prominence has been given in recent years to the artificial drying of young grass as a means of conserving a fodder rich in protein and carotene to serve as an additional concentrate food for stock. The protein content of the grass, (in south of England) on the basis of dry matter, varies between 18·3 and 30·6 per cent.

The use of Ammonium sulphate as a top dressing was found extremely beneficial in stimulating growth and the production of protein and carotene in the grass.

The disadvantage of the use of dried young grass as a concentrate fodder appears to be the cost of production. —C.R.T.

*(To be continued.)*

# REVIEWS.

## FRUIT FLIES IN MALAYA.

A recent article (1) deals with fruit-flies in Malaya and though the suggestions for control are very similar to those given before for Palestine (2) and Ceylon (3) yet it seems desirable to enumerate them from this very recent source.

The most important factor in reduction of fruit-flies is clean culture, *i.e.*, the removal and destruction of injured and infested fruits which can then be boiled or buried to a depth of 6 inches and the soil well beaten down.

The protection of growing fruit by the Chinese method of bagging is sound for citrus and tomatoes but for cucumbers a tube can easily be made out of square pieces of newspaper which are squeezed round the stem of the young vegetable and tied with cotton.

Besides the Jarvis or Queensland lure described by Simmonds (4), success was also obtained in Malaya with the solution made of $\frac{1}{8}$ fluid oz. of formalin (40 per cent. formaldelyde) and 13 oz. sugar dissolved in 26 ounces of water. This can be hung from branches in open cigarette tins protected from the entry of rain by a simple cover. R.J.A.W.L.

(1) Miller, N. E. E., 1940 *Malayan Agricultural Journal*, XXVII No. 3, March.
(2) *Fiji Agricultural Journal.* 1938, Vol. 9, No. 2.
(3) *Fiji Agricultural Journal.* 1939, Vol. 10, No. 3.
(4) Simmonds, H. W., 1936. *Bulletin No.* 19. Department of Agriculture, Fiji.

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## BUILDINGS AND WHITE ANTS.

This pamphlet by the Government Entomologist, Jamaica, deals at length with the precautions needed in the tropics to ensure protection of wooden buildings from the attacks of white ants (termites) and moulds or fungi.

The writer shows that these insects can be divided into two groups, viz., those which can enter buildings only by boring through or creeping over walls, steps, trellis work or trees, all of which act as bridges between the ground and some part of the building. The second group infests structures by direct flight and so needs no connexion with the exterior. These are the so-called " powder post " or dry-wood white ants.

The fundamental principle for the control of both of these groups is the complete insulation of the wooden parts of buildings from the ground and if properly carried out one can insure permanently against attacks from subterranean or tree-nesting forms and considerably reduce risk of infestation by dry-wood termites and wood-rot caused by fungi.

The removal of all infested stumps or pieces of wood from the site should be carried out thoroughly before construction and only properly seasoned lumber should be used for buildings. Details of the actual foundation walls, metal shields, and piers concern the builder and so are not reviewed here, but it is emphasised that all wood coming into direct contact with concrete should be thoroughly impregnated with coal tar creosote before it is fixed. Frequently, addition of steps and railings to a carefully constructed house allows of access to white ants which would have failed to gain an entry had the building been left as designed by the architect. Another common means of invasion is by a branch extending from a tree at some considerable distance, making contact with woodwork and so forming a bridge for termites, already present in the tree, which thus reach the house.

So much for preventive measures, it now remains to discuss remedies for buildings already infested. Injections are made in the woodwork at intervals of two to six feet and Paris Green or white arsenic (both deadly poisons) are

blown in with a blower as used with liquid insecticides for mosquitoes and cockroaches. Fumigation can also be practised but requires skill and may be risky. A third method is painting with creosote, zinc chloride or other liquids which can also be used for pouring into nests of soil-breeding termites.

Such considerations as drainage of the soil, ventilation by having tall enough posts or piers made of creosoted hardwood and using well-seasoned timber are apt to be overlooked.

Although termite control was dealt with over a year ago in the first number of Volume 10, March, 1939, (pp. 18 to 19) no excuse is offered for the review of this excellent bulletin which many people in the Colony may care to order from Jamaica for themselves at half-a-crown a copy.

"The Preservation of Wooden Buildings in the Tropics" by H. W. Edwards. Department of Science and Agriculture, Jamaica, 1939. 2s. 6d.

R.J.A.W.L.

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## STORAGE OF GRAIN IN RELATION TO INSECTS.

THE issues for last October and November contained articles and a review on the storage of grain which has assumed increased importance since the outbreak of hostilities and so received attention at the last Agriculture Show where an exhibit of grain pests was staged. Two papers are here reviewed.

(1) Cleanliness before storage is essential and when fumigation is impossible the store should be thoroughly swept out and the roof, floor and walls sprayed with kerosene, in each gallon of which 1 lb of pyrethrum powder has been dissolved. The building should remain closed for twenty-four hours and upwards before storage begins. Weevils (which have pointed snouts) can be controlled by adding 1 part of finely ground limestone to 50 or 100 parts of the grain—a trial will show if the smaller ratio will suffice. This treatment is useless against the pulse beetles (small, squarish beetles either brown or spotted but without beaks) but these, as well as the weevils, can be checked by a layer of 2 to 3 inches of clean, dry sand spread on the top of the containers in place of the usual lid or cover.

Sunning of the grain before storing on really hot days should always be done when possible, but neither this nor fumigation is a guard against re-infection by bringing in undried or dirty grain.

Fumigation requires care and must always be done under European supervision. The safest is carbon bisulphide, using 5 lb for every 1,000 cubic feet of space or 1 lb for 25 bushels of grain which weigh 1,250, 1,400 and 1,500 lb respectively for rice, pigeon pea and maize when the containers are full of grain.

(2) Stored products may be infected (1) before storage, *i.e.*, in the field or in transport from the field to the store or (2) during storage, *i.e.*, through being placed in infested buildings or containers.

Obvious precautions to cut down this injury are efficient securing of windows and doors, good lighting and ventilation as all the beetles and fig moths concerned thrive in a dark, still temperature. Sterilising in boiling water or direct exposure to sunshine of barrels, sacks and bins should be done annually. The spraying mentioned above should be carried out using kerosene or some standard disinfectant and the walls and ceilings white-washed. Rubbish and refuse should be burnt, particular attention being paid to old heaps of grain and rubbish between floor boards and in corners. An undisturbed food-supply forms the ideal breeding ground and if control of this is arrived at the infestation will never be serious. —R.J.A.W.L.

(1) W. V. Harris is *East African Agricultural Journal*, Vol. 5, No. 5, March, 1940.

(2) Agricultural Advisors to the Secretary of State for the Colonies, Colonial Office, 1939.

## COPRA NOTES.

The following statements are contained in the half yearly report of Mr. J. C. Cooke, Chemist, Coconut Products, Malaya, for the period January to June, 1939:—

1. It is undesireable to harvest unripe nuts but considerable loss of copra occurs if, in order to avoid harvesting unripe nuts, no nuts are cut and fallen nuts only are collected monthly. This is owing to extensive germination of the nuts on the ground.

2. Under-dried copra is progressively more susceptible to decomposition than dry copra whatever the conditions of storage. The loss of copra that results increases rapidly with increasing moisture content.

3. Under-dried copra will show greater decomposition and loss when stored in small quantities than when stored in bulk, especially if there has been careless preparation.

4. It is good to build up loose copra into huge stacks so that it is able to dry rapidly by its own heat of decomposition. This limits the amounts of decomposition and incidental loss of copra. —H.W.J.

—(From Bull. Imp. Inst. Vol. 37, No. 3, 1939)

## COPRA GRADING.

At the meeting of the Legislative Council in February an Ordinance entitled a " Bill to Improve the Quality of Copra " was passed and placed on the statute book. Its operation, however, has been postponed pending a solution to the present shipping difficulties and, from the European viewpoint, the unremunerative price of copra.

Ultimately, it is hoped that compulsory grading will be of much assistance to planters in securing better prices for good copra and in gaining a better reputation for this commodity on the world's markets.

## COCONUT CHARCOAL.

In his article entitled " The Destructive Distillation of Coconut Shells " Dr. Child of Ceylon states that 100 lb of shells normally produces 34 lb of charcoal, 40 lb of pyroligneous acid (of about 12 to 15 per cent. acetic acid content), 6 lb of tar and 20 lb of gas.

Some 300 million coconut shells (or about 40,000 tons) are burned annually in Ceylon to produce about 13,600 tons of charcoal, though no attempts are made to recover the by-products. These would amount to about 16,000. tons of pyroligneous acid (equal to 2,000 tons of acetic acid).

The chief difficulties to the utilization of by-products of coconut shells relate to the collection and transport of raw material and the centralization of charcoal production. In Ceylon there are several copra manufacturers and desiccated coconut mills in which 15 million nuts are handled annually —this number of shells, about 7 tons per day, would suffice to keep running a fair sized installation.

The chief advantages in Ceylon are the local existence of a market for charcoal and for acetic acid (rubber industry) and the fact that shells, by reason of their low moisture content and high acetic acid yield, are particularly suited for distillation.

The by-product tar, contains carbolic acid and creosote which may be of utility locally. —H.W.J.

—(*The Tropical Agriculturist.* Vol. 93, No. 4, 1939.)

## THE CONTROL OF WEEDS.

The Imperial Bureau of Pastures and Forage crops has, in Bulletin 27 (under the Editorship of R. O. Whyte), presented a valuable survey of recent work in many countries on the prevention and eradication of weeds on agricultural land by cultural, chemical and biological means.*

The Bureau was able to arrange for the co-operation of specialists in Canada, United States of America, Germany, Australia, New Zealand and South Africa—and the publication is a symposium of articles dealing with various aspects of the problem in those countries.

The first article is a contribution from the Research Laboratory of Plant Ecology, University of Saskatchewan dealing with investigations relating to weed control in Western Canada where the weed problem is of great complexity. The article deals with the organisation and results of research in connection with weed control under the scheme of the "Associate Committee on Weeds."

Some of the significant results of weed investigations are discussed particularly with reference to the competition between weed and crop plants—the control of annual and perennial weeds by chemicals and cultural methods; practical recommendations for weed control under dry farming conditions in Canada are also given.

In the second contribution from Canada, R. H. F. Manske urges chemical analysis as an aid to classification of poisonous plants,—and suggests that specific identifications of certain weed species may be facilitated by the isolation and identification of their alkaloid or alkaloids.

Poisonous plants in pastures are also discussed by R. G. Steyn of South Africa where plant poisoning in stock is a serious problem. Of local interest are the references to (1) Hydrocyanic acid poisoning on grass pastures, attributed to species of *Cynodon* and other members of the grass family under abnormal climatic conditions, and (2) Pasture plants causing photosensitization—namely *Tribulus terrestris* and *Panicum maximum*, both of which occur in Fiji.

The three articles from United States of America are as follows:—

1. "The Farm Weed Problem in America," by L. W. Kephart.
2. "Principles of Chemical Weed Control," by A. S. Crafts and R. N. Raynor.
3. "Weed Control in Turf," by J. Monteith Jr.

These articles describe the weed situation, the American weed and seed Laws and the weed research and control problems. The methods of chemical control are discussed under the following headings (1) contact sprays both non-selective and selective, (2) translocated sprays and (3) soil treatments including both temporary and permanent soil sterilization.

It is stated that the most urgent weed problem of the moment in United States is that of the persistant, aggressive destructive, chiefly perennial species of which there is no adequate control, also the need for determined public support of legislation, aided by a sound programme of education, is stressed as an important factor in bringing measurable relief from the weed menace.

"The Control of Weeds in Germany," by B. Rademacher, dealing with the most important weeds, preventive measures by cultural and chemical means and Government measures of that country,—is a well-illustrated and instructive contribution in which the value of community effort is again stressed.

" Some Australian Weed Problems," by G. A. Currie, outlines legislative and research activity, and describes the more important weeds of Australia and the measures taken to control them. These comprise Life History studies, Chemical and Entomological Control, Pasture management Smothering plants, Cultivation and Rotation of crops.

Of interest to local readers is the reference to Nut Grass (*Cyperus rotundus* L.), Noogoora Burr (*Xanthium pungens* Waller) and Lantana (*Lantana camara* L.)

It is stated that cultivation of the ground at not less than three weekly intervals during two growing seasons will reduce nut-grass to negligible proportions, that no chemical treatment, short of soil sterilization, has been effective and that liberation of Nut grass insects from Hawaii is unlikely owing to the fear that these insects might attack useful species of *Cyperus* which constitute valuable grazing plants in certain areas of Queensland and Northern New South Wales.

The other article from Australia by A. P. Dodd, discusses the highly sucessful biological control of prickly pear in Australia—while D. Miller presents a statement on the biological control of noxious weeds in New Zealand. E. B. Levy emphasises the ecological aspect of the problem of controlling weeds in pasture—and concludes that practical control on the farm must rest (1) on the formation and maintenance of dense pasture swards by strict adherence to persistent strains of suitable species and by top-dressing to a high productive level,(2) on management of grazing so as to afford periods of recovery and (3) on the use of specific classes of stock which graze the weed rather than neglect it.

The publication under review constitutes a valuable handbook on the subject of weed control, is fully illustrated with excellent photographs and presents a large amount of information of great interest to the agriculturist and stock-owner. —B.E.V.P.

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* "*The Control of Weeds.*"—A symposium on the prevention and eradication of weeds on agricultural land by cultural, chemical and biological means. Herbage Publication Series, Bulletin 27.

Imperial Bureau of Pastures and Forage Crops, Aberystwyth, Gt. Britain, January, 1940—Price 7s. 6d.

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## PEANUTS.

This valuable crop deserves more attention locally since it grows readily, yields fair crops of kernels (about 1,000 lb) and of hay (25 cwt.) under moderate cultivation in suitable soils.

The crop is ready for harvest when the kernels do not shrink after being pulled and sun-dried for a few hours and when the inside of the shells show dark lining.

Threshing is easily done if the nuts are well dried by drawing the plants over a wire netting table.

The nuts may be eaten raw or cooked or as peanut butter or as oil. The best oil is derived from shelled, blanched, cleaned nuts and is highly esteemed as a cooking oil and as substitute for olive oil, salads etc.

The less clear oil is used in the manufacture of margarine, soaps, furniture cream, peanut butter, etc.

Peanut meal is a good stock feed for all kinds of stock and poultry if used sparingly. The nutritive value of the crop is indicated in the following table which shows peanuts to be richer in protein than meat.

| | Water. | Ash. | Ether Extract. | Protein. | Fibre. | N-Free Extract. |
|---|---|---|---|---|---|---|
| Peanut shelled .. | 7·2 | 4·3 | 8·4 | 51·7 | 4·7 | 23·8 |
| Crushed whole peanuts .. .. | 6·2 | 4·0 | 7·3 | 36·6 | 24·3 | 21·5 |
| Low grade cake .. | 8·3 | 2·7 | 8·8 | 43·4 | 12·1 | 24·7 |

One ton of nuts can produce 70 to 80 gallons of oil or one bushel of nuts one gallon of oil, that is, the nuts contain 40–45 per cent. of oil.

Hogging off is common in U.S.A. where it is stated that with peanuts at 3d. per lb, peanut hay at £3 per ton and pork at 7½ per lb, it pays to hog off an average crop of 1,000 lb. Forage and 1·84 lb of peanuts are reported to produce 1 lb pork and it is stated that an acre of peanuts (39 bushels) provides grazing for 7 pigs, averaging (at beginning) 63 lb each, for 2 months.—H.W.J.

(Notes from "The Peanut" by Wenholz and Nickholson. Department of Agriculture, New South Wales, 1926).

## EXTRACTS.

### THE VEGETABLE OIL MARKET.

THERE seems to be no doubt about the fact that under normal circumstances the United States is producing a continuously increasing share of its needs of fats and oils. Due to the prevailing low prices of corn, hog production has increased tremendously. For some time past, loose lard has been used extensively for soapmaking in the central States, as it has been available to the soap manufactures at considerably cheaper prices than coconut oil. Indirectly the low price of refined lard has caused a material decrease in the consumption of compound lard and vegetable shortening, and manufacturers of these latter products have increased the proportion of domestic oils used in the manufacture of these products at the expense of higher priced imported oils, in order to reduce their costs and thereby remain competitive. This was facilitated by the cheap price of soya bean oil, production of which has also increased very considerably.

The outlook for Philippine copra, production of which has been steadily increasing, is thus unfavourable as long as the adverse factors just mentioned continue to prevail in the United States; however large sales of copra and coconut oil to Europe and other countries outside the United States were during 1939, they were not substantial enough to offset the unfavourable influence of these factors on the market, and merely served as a brake to the downward trend which, in the absence of these substantial sales, would probably have carried prices to disastrously low levels.

In view of the uncertainties resulting from war conditions, it would be idle for us even to attempt a forecast of the market trend during 1940. Shipping facilities are still lacking for many destinations, and ships have been withdrawn lately even from the transpacific run, on which route conference rates are not in keeping with world freight markets. Wartime conditions, with the attending destruction of shipping, higher costs of fuel, insurance, bags, wages, &c., seem to foreshadow a tightening of available shipping space and increasing freight rates.

In many trade circles it is felt that unless very substantial quantities of American lard, soya beans and cotton seed oil can be exported to Europe, the United States is not likely to increase, but on the contrary to reduce, its imports of foreign oils and oil-bearing materials. —H.W.J.

## PROTECTIVE FOODS.

Milk, vegetables and potatoes between them contain all the food constituents necessary for health. If everybody has sufficient of these, there need be no malnutrition. If we have the right agricultural policy we can produce sufficient for the needs of the whole population, without reducing the pre-war output of other foods.

With sufficient of these three protective foods, we could, if we were forced by lack of shipping space or foreign exchange, limit imports to the cheap, easily carried, energy-yielding foods. The following table shows the estimated storage space, energy value, and price of some of the main foods we import.

| | Approximate shipping space (cu. ft. per ton). | Approximate energy value (1,000 calories per cu. ft. shipping space). | Cost of 100,000 calories. |
|---|---|---|---|
| | | | £ s. d. |
| Sugar .. .. .. | 45 | 83 | 0 4 6 |
| Wheat .. .. .. | 50 | 56 | 0 5 6 |
| Fats and Tallow .. | 80 | 118 | 0 8 6 |
| Dried fruits .. .. | 50 | 55 | 1 1 0 |
| Cheese .. .. .. | 60 | 56 | 1 19 0 |
| Frozen beef .. .. | 95 | 26 | 2 0 0 |
| Eggs in shell .. .. | 120 | 12 | 3 15 0 |

Considering only nutritional needs, however, priority in imports should be given to bread and fat, until we have a reserve which puts us beyond the danger of a shortage. In 1914–18 we tried to get a reserve of thirteen weeks' supply, but could not maintain it at that level.

With the uncertainty of the present war, we should have at least a six months' reserve of wheat and fat. Of the other foods, sugar is the cheapest energy-supplier in terms both of money and shipping space, and would probably be put next to wheat and fat in the list.

If we had sufficient of these energy-yielding foods, together with sufficient milk, vegetables and potatoes, we might be reduced to a spartan diet, but there would never be any need for us to capitulate owing to food shortage.

Though these three protective foods and three energy-yielding foods might well form the basis of a national dietary in war-time, it is not suggested that the diet of any part of the population should be reduced to these. Even if shipping space were reduced to a minimum, we would have, in addition to these, all the other foods we can produce at home.

The most difficult problem is not the maintaining of supplies to meet nutritional needs; it is, as it was in peace time, one of bringing a sufficient amount of the right kind of food within the purchasing power of working-class families with children. It has already been decided to subsidize food. It might be advisable to confine the subsidies to the absolutely essential foods and to make it sufficient to bring the price of these within the purchasing power of every family.

To provide for the different physiological needs and for different likes and dislikes, it would be necessary to leave a margin of money for the purchase of other foods. Thus, for example, if milk, vegetables and potatoes, bread, fat (butter or margarine) and sugar are chosen as the essential foods to be subsidized, and, if it were found that, say 4s. 6d. a week was the amount

available for food among the poorest 10 per cent. of the population, the price of these basic foods should be fixed so that a sufficient amount of them can be bought for, say 3s., leaving 1s. 6d. for the purchase of other foods, such as beef, mutton, fish, fruit, and tea and other beverages.

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## THE GIANT TOAD IN QUEENSLAND, AUSTRALIA.

"A comprehensive series of experiments for the purpose of studying any effect that toads may have on the domestic fowl were carried out during the year. The experiments were designed to test out the effect of:—

(1) Possible contamination of drinking water by toads bathing in the water overnight.
(2) Contamination of the water by urinary excretions of the toads.
(3) Feeding young toads to fowls.

"The tests to which the fowls were subjected were particularly severe, but no ill effects were noticeable in any way. In the feeding experiment one fowl ate no less than 142 small toads within the space of about one hour, yet it remained quite normal. These experiments are supported by the experience of some commercial poultry breeders who deny that any harm has resulted from the presence of toads in the breeding pens.

"A systematic examination of the stomach contents of toads was carried out during the period December, 1938 -April, 1939, to determine what constitutes the food of toads in their new habitat in North Queensland cane areas.

"Unfortunately it was not possible to collect toads in the few areas where Greyback beetles (*Lepidoderma*) were flying in appreciable numbers, and accordingly this pest was not represented in the material taken from the toad's stomachs. However, a pleasing find was 15 "frenchi" beetles (*Lepidiota frenchi* Blkb.) in the stomach of one toad, and 13 in another, whilst reports have come to hand that toads have gorged themselves on these beetles where the latter were plentiful. It was also gratifying to find that comparatively small toads (2 inches to 3 inches in length) had eaten other sugar-cane pests, namely sugar-cane borer weevils (*Rhabdocnemis obscura* Bois.), and numbers of army worms (*Spodoptera exempta* Wlk.)"

Bell, A. F., in 29th Annual Report of Bureau of Sugar Experiment Station, Queensland, 1939.

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[One by one the various objections raised against the introduced toad are found to rest on scanty foundations. The above extract shows that in Queensland young toads are harmless when consumed by poultry. The beetles named are very close allies to the *Rhopæa* of the Fiji cane fields.

Stomach contents included the following insects in the above article:—

Cockroaches, crickets, earwigs, white ants, plant bugs, chafers, stag-, leaf-, ground-, water- and click-beetles, ladybirds, weevils, ants, cutworms and other caterpillars. The majority were chafers, hardbacks and greybacks.

It is on interest to record that the small indigenous tree frog, *Cornufer dorsalis* A. Dum., devours the dark burnished plant-bug *Brachyplatys pacificus* Dall. which is a pest of beans. This frog occurs within nine miles of Suva though one has heard that it was exterminated on Viti Levu Island by the introduced mongoose.] —R.J.A.W.L.

## TANGIMAUTHIA.

A FLOWER OF FIJI.

By
R. W. PAINE, B.A. (*Cantab*).
Ex-Entomologist, Coconut Committee, Fiji.

In the mountain forests on Taveuni, a small island in Fiji, there grows a most interesting and beautiful flower known as the Tangimauthia. This name, compounded of three Fijian words which may be translated " Crying in vain," originated from a legend about a child prince who lived in a mountain village on Taveuni now no longer in existence.

But the interest in this plant which has arisen among Europeans in Fiji is due as much to its striking appearance and the idea that it is an orchid only to be found beside the mountain lake on Taveuni, as it is to the legend associated with its name.

Mist hangs almost permanently over these tropical mountains, which rise, in a ridge of extinct volcanic craters, to just over 4,000 feet, and the vegetation which clothes their summits is refreshed with a rainfall exceeding 250 inches in the year.

Amid a landscape of sombre and monotonous shades of green the riot of its brilliant crimson flowers circling the trunk of a forest tree presents a startling appearance, and although not uncommon in its own particular habitat the first glimpse of Tangimauthia in full flower is one of the few real excitements to be met with in the Fiji forests.

The plant, which resembles honeysuckle in its manner of growth, is in flower from November to March, throwing pendulous trusses of fuchsia-like flowers, each about an inch long. Purple-haired stamens and white sepals and petals are ensheathed by crimson bracts, which, with red flower stems, produce such a vivid splash of colour.

The popular idea that the Tangimauthia is an orchid still lingers on despite the complete lack of resemblance it bears to those much-prized members of the tropical forest flora. It belongs, in fact, to a family of plants (Melastomaceæ)—native of South America— included in which, ironically enough, is one of the worst plant pests in Fiji, *Clidemia hirta*. And it was a surprise to many settlers to learn recently that the beautiful Tangimauthia was a relative of this introduced " Curse " of their grazing land. Nor has local opinion been correct in limiting the occurrence of the plant to the environs of the Taveuni mountain lake. It is to be found all over that island above a height of about 2,500 feet, and in 1933 a visiting botanist found the same plant, or a close variant, on the much larger neighbouring island of Vanua Levu.

The Tangimauthia was given its cumbersome and relatively inappropriate botanical name, *Medinilla waterhousei*, by Berthold Seemann, an English botanist, who visited Fiji in 1860 in order to make a report for the British Government on the timber and plant life of the archipelago. Seemann was on Taveuni at a time of year when the Tangimauthia was not in flower, and thus failed to appreciate that the very ordinary looking creeper, which he collected and named after a missionary with whom he stayed, produced flowers of conspicuous beauty held in high regard by the Fijians. It was on the occasion when a botanist from the Bishop Museum, Honolulu, was packing flowers of Tangimauthia that the exact botanical relationship of the plant was revealed to Fiji residents in January, 1934.

—*United Empire*, Vol. XXVIII, No. 9, September, 1937.

## WHALE OIL.

PRODUCTION by countries of control (in thousands of tons) is as follows:—

| | 1931 | 1932 | 1933 | 1934 | 1935 | 1936 |
|---|---|---|---|---|---|---|
| British Empire .. | 188 | 134 | 197 | 199 | 215 | 197 |
| Foreign .. .. | 426 | 19 | 236 | 230 | 234 | 202 |
| Total .. | 614 | 153 | 433 | 429 | 449 | 399 |

The average world production for the six years quoted is, thus, 413,000 tons of which the United Kingdom imported in 1936, 1937 and 1938, 135,455 tons, 151,973 tons and 225,625 tons respectively. The figures of annual production would indicate that the use of whale oil had reached, more or less, a state of equilibrium, that is, where it can be, it has been substituted for other oils. Coconut oil now forms only some 20 per cent. of the raw materials used in the manufacture of margarine.

Of the total production approximately 90 per cent. comes from the Antartic regions. In the manufacture of margarine in the last decade the use of whale oil has been increased by some 22,000 tons, mainly at the expense of coconut oil.

Whale oil is a cheaper product than coconut oil as portrayed in the following table of prices per ton.

| Year. | Maximum prices. | | | Minimum prices. | | |
|---|---|---|---|---|---|---|
| | Whale. | Coconut. | Difference. | Whale. | Coconut. | Difference. |
| | £ s. d. | £ s. d. | £ s. d. | £ s. d. | £ s. d. | £ s. d. |
| 1932 | 16 0 0 | 28 15 0 | 12 15 0 | 10 0 0 | 21 0 0 | 11 0 0 |
| 1933 | 14 0 0 | 23 5 0 | 9 5 0 | 10 0 0 | 14 10 0 | 4 10 0 |
| 1934 | 13 0 0 | 14 15 0 | 1 15 0 | 8 0 0 | 12 5 0 | 3 15 0 |
| 1935 | 20 0 0 | 24 0 0 | 4 0 0 | 10 0 0 | 19 0 0 | 9 0 0 |
| 1936 | 20 0 0 | 32 10 0 | 12 10 0 | 17 0 0 | 21 15 0 | 4 15 0 |
| 1937 | 23 0 0 | 34 0 0 | 11 0 0 | 17 0 0 | 19 10 0 | 2 10 0 |

(From " Coconut Oil and Whale Oil " by R. Child. *Ceylon Trade Journal*, Vol. 4, No. 9, 1939. —H.W.J.

## SOIL CONSERVATION.

(Adapted from Journal of Jamaica Agricultural Society, Vol. 44, No. 1, January, 1940).

OUR efforts to make Fiji less dependent on imported foodstuffs should not blind us to the increasing necessity for conserving wisely our soil resources. Unless we prevent soil erosion, we can never maintain production and we will have to face the general impoverishment which soil wastage inevitably brings.

In putting land into production of food crops, the following points must be kept clearly in mind:—

1. Do not cut down forest or bush on steep slopes, along the crests of ridges, along stream banks, at the head of springs, or on slopes immediately above a road.

2. Do not cut down forest or bush on poor rocky soil that can only produce one or two crops and is then unproductive.

3. Do not burn the land and above all, do not let fire get away from you: if you must burn brush, pile it in heaps and watch it until the fire has gone out.

4. Cultivate and plant your crops on the contour.

5. If you dig drains, dig them on the contour with a gentle slope to a natural water outlet or stream.

6. Establish cover crops, such as beans and cowpeas and mulch generously with slashed weeds and grass to maintain organic matter in the soil.

7. Do not clear large areas on steeply sloping land; leave contour strips of bush at intervals to slow down the run-off of water and soil.

8. Cut head trenches above field to take off surplus water in wet areas, and catchment (blocked) or blind trenches in dry areas to catch water.

9. When making tracks through fields, lay them out on easy grades, as steep tracks on loose soil encourages gullying.

10. When planting food crops, yaqona, &c., on sloping land, do not dig out all the tree roots as is usually done, as this causes landslides and break-aways on the slopes.

11. In windy areas, leave a belt of trees as a windbreak to protect the field.

Why are these measures necessary? If we do not carry them out, all the rich top soil will be washed out of the land and yields will get smaller: gullies will cut deep into the soil and silt will be carried into the streams and rivers: floods will increase in wet weather and streams and springs will dry up in the dry weather.

Any efforts we can make to reduce soil and water losses will pay handsome dividends: the soil belongs on the fields, let us keep it there. —C.H.

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## THE R. H. PHILLIPS' COLLECTION OF FIJIAN MOTHS.

By
A. MUSGRAVE.

THROUGH the generosity of Mr. R. H. Phillips, the Australian Museum has recently acquired a large collection of Fijian moths secured by him during a residence of thirty years in the Fijian Group.

Mr. Phillips began his collecting in Fiji whilst in the service of the Fijian Government, which he entered in 1908; in 1915 he was an Inspector of Plants*, and in 1928, upon retiring from the Government service, he joined the Colonial Sugar Refining Company, and was in their employ for three years

The collection, which consists of some 873 specimens, includes about 400 named species and 455 unidentified specimens, and is set and properly labelled, and two field registers which accompany the collection give additional data as to the food plants of the larvæ and other particulars. The identification of the specimens has been undertaken for the most part by specialists in England, where many families have received the attention of Mr. Edward Meyrick (whose death was reported from London in April of this year). In his serial work, *Exotic Microlepidoptera*, appear the descriptions of the new species collected by Mr. Phillips and other Fijian entomologists, and on looking through this work from 1930 onwards, one is struck by the constant recurrence of Mr. Phillips' name in connection with Fijian moths Mr. Louis B. Prout (1), of Tring Park Museum, has also described a number of species of Geometridæ collected by Mr. Phillips. Mr. W. H. Tams (2), of the British Museum (Natural History), has also described and figured an Agaristid Moth, *Seudyra bostrychonota*, from Lautoka, Fiji, collected by Mr. Phillips, specimens of which are in his collection.

* No such title gazetted in the Civil List for 1914–16.—Editor, *Agricultural Journal.*

Mr. Phillips has kindly furnished me with a few remarks on the conditions of insect life in the Fiji Islands, which might perhaps help to influence anyone who was possibly considering a trip there.

"The main island, Viti Levu, although no more than about 100 miles in diameter, has a very great range of climate. The north-east, north, and north-west coast is dry and hot, and has variations as it rises from sea level to 4,000 feet. There is a great change in plant life at these varying levels, and consequently in the insects that feed on them. After 3,000 feet insect life in this zone becomes scanty. Travelling in either east or west directions towards the south, conditions become gradually more tropical, until dense jungle is met with, and this teems with insect life. Making into the interior, the jungle persists to the highest levels, though a great variation of plant and tree life is met with, and insects are taken which are rarely met with on the lower levels or on the dry side. This is the country of almost incessant rain. To a certain extent these conditions of wet and dry zone are met with on the other large islands; there are over 200 islands in the Group. The larger outlying ones could be visited at small expense, and in the farthest out, where perhaps the destructive bulbul and mynah have not penetrated, there may be treasures worth the pains of collecting. The insect life on Rotumah, a well isolated group some 200 miles to the north-west, might well be interesting . . . . . Lodgings on these trips would be in native villages, and, though doubtless the visitor would go armed with net and cyanide bottle, still it would be as well to add a tin of Keating's powder to the list, or insects that were not needed might be inadvertently collected."

*The History of Moth-Collecting in Fiji.*

In dealing with Mr. Phillips' collection a few words might not be out of place on the history of moth-collecting in Fiji, so as to place Mr. Phillips in a proper perspective among his confréres of the butterfly net and killing bottle

Among the first collectors to visit the Group were the early French explorers in their quest for the missing vessels of La Pérouse. In 1824 the *Coquille*, under L. I. Duperrey, visited the Group and neighbouring islands, but apparently no records of moth captures exist. From May 25 to June 8, 1827, the French corvette *Astrolabe*, under the leadership of Dumont D'Urville, was in Fijian waters, and accompanying the veseels were such well-known collectors as Lieut. C. H. Jacquinot and the surgeons J. R. C. Quoy and J. P. Gaimard and P. A. Lesson. In 1838 the corvettes *Astrolabe* and *Zélée*, also commanded by Dumont D'Urville, touched at Fiji during October of that year. Despite the fact that six members of the expedition, including the leader, made collections of insects, no Fijian moths appear among the insects described in the scientific results of the expedition.

European settlement did not take place until 1835, when the first missionaries became established there. Thus collecting may be said to date from about 1860, when the great Museum of Godeffroy in Hamburg sent its collectors far and wide into the Pacific. Of these may be mentioned Dr. Eduard Graeffe, Captain Theodor Kleinschmidt, Franz Hubner, Mr. Andrew Garrett; papers on the material collected by them appeared in the journal of the Godeffroy Museum and lists of specimens in the calatogues of the Museum. Among these latter we note Fijian moths, mostly species with a wide range and not native to the Group.

Fiji was ceded to Britain in 1875,† and in the previous year H.M.S. *Challenger* while on her voyage round the world, spent some time there. Collectors now began to pay more and more attention to these islands, and the names of Fijian insects appeared more often in scientific journals. Those who are interested in the literature of Fijian entomology will find the more important papers on the subject listed at the end of this article.

Mr. M. Bezzi has pointed out in his work, " The Diptera of the Fiji Islands," with regard to the flies of Fiji, that a careful study of the literature to the end of the year 1925 shows that only a few species had been recorded up to that year. As I have shown, the moths have received somewhat better consideration; nevertheless, it is only during the past decade or so that the study of the moth fauna of the Group has received any serious attention. With the establishment of the sugar-cane industry, and the growth of such organizations as the Colonial Sugar Refining Company, and the Department of Agriculture of the Fijian Government, it became necessary to employ entomologists to combat pests, so that the study of the Lepidopterous fauna of the Fijian Group was inevitable. Thus we find in literature relating to the entomology of these islands the names of such contemporaries of Mr. Phillips, as Dr. Guthrie, R. Veitch, R. J. A. W. Lever, (the last named being the present Government Entomologist), W. Greenwood, H. W. Simmonds, and the donor's son, Mr. C. S. Phillips.

Such, then, is an epitome of moth-collecting in the Fijian Group, and it will be seen that the Australian Museum, in reaping the benefits of Mr. Phillips' industry, has been extremely fortunate in the acquisition of so large a collection of so neglected an order.

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(1) Prout: Stylops, 3 (11), 1934.
(2) Tams: Entomologist, 62: 1929.

† Should be 10th October, 1874.—Editor, *Agricultural Journal.*